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SPELLING.

It is matter for regret that so much of the time in our schools, which is appropriated to spelling, should be lost, in consequence of the unskilful manner in which the exercise is conducted on the part of the teacher.

We propose at present to point out only one defect, but it is a serious and a prevalent one. It is that of mispronouncing the word to be spelled, in order to give the speller a clew to its orthography.

If scholars are sent to school to learn, among other things, how to spell the words of the English language, then it is clear that English words, with the true English pronunciation, should be put out to them. It is of no use to put out such words to them as they never hear spoken, or read, because to learn to spell any number of the latter does not inform them how to spell the former.

Take the word *fidelity*, for instance, in which the sound of the vowel *i*, in the first syllable, is obscure, and therefore that syllable has almost or quite the identical sound of *phy*, in the word *geography*, or *philosophy*;—suppose this word is put out with the correct pronunciation, and the scholar begins to spell it with the letters, *f e*, when the teacher arrests him, and puts out a new-coined word, *fi-delity*,—giving to the vowel *i* the long sound,—then the scholar may follow him, and call the letters right, but he has learned nothing, for there is no such word in the English language as *fī-delity*. Hence the scholar is in danger of acquiring a false pronunciation, *fī-delity* instead of *fidelity*, and of not being able to spell the word correctly when he shall have occasion to write it. In some schools, and with some teachers, this departure from correctness becomes very gross,—so much so as to indicate a distinction between the terminations, *tion*, *sion*, *cion*, and so forth,—as *ti-on*, *si-on*, *ci-on*, not *s*, &c.

Such a practice as this obviously supersedes all necessity for studying the lesson. It supersedes even the exercise of the memory, at the time of the recitation. If the pupil foreknows, from custom, that the word will be substantially spelled for him, he will take no pains to prepare himself for the recitation; and if it is substantially spelled for him, at the recitation, he will forget it in a minute.

To make this more plain, let us take some words whose orthography differs widely from the simple powers of the letters of which they are composed. For this purpose we have no occasion to search for long and difficult words. Almost any simple table at which we open in the spelling-book, will furnish illustrations. If we admit that a word is ever to be so pronounced as to give the speller an indication of its orthography, we may say *de-ad* for *dead*, *he-ad* for

head, thre-ad for *thread, law-su-it* for *lawsuit, re-cru-it* for *recruit, be-ef-ste-ak* for *beef-steak*, and so forth.

Something precisely analogous to this is often done in regard to the imperfect and past tenses, and past participles of the regular verbs, where the *ed* is sounded as though it were an additional syllable,—*vow-ed* for *vowed, sow-ed* for *sowed*, &c. &c.

Why not, on the same principle, in putting out the tables of abbreviations, enunciate the very word or words, abbreviated? Why not say, A. B. Bachelor of Arts, to inform the pupil that he is expected to echo back, Bachelor of Arts?

The true process of learning to spell consists in the pupil's looking intently at the word, and taking the image of it into his mind,—that is, noting each letter in it, the order of their succession, and the manner in which its syllables, if it is not a monosyllable, are divided. The whole is to be pictured in his memory, and the picture associated with the English pronunciation, so that when called upon to spell, he may, as it were, *read* from the tablets of his memory, just as he had before read from the printed pages of the book. Without this imprinting on the mind of the successive letters and syllables, and associating them with the true pronunciation, so that either one will have the power of calling up the other, nothing is done. All the time spent is lost, and worse than lost, for a bad habit is formed.

Why does it not occur to *all* teachers, as it certainly does to all good ones, that it is no object to have all the words in the dictionary spelled right, *at the recitation*, if the power of spelling them right, a month, a year, or many years afterwards, is not gained?

Another practice, hardly less pernicious, into which some teachers fall, consists in alternately checking and prompting the pupil;—that is, in checking him, if he is going wrong, in prompting him, if he hesitates. The pupil, being about to spell a word, fastens his eye upon the teacher;—if doubtful whether to use an *i*, an *e* or a *y*, he utters one of these letters hesitatingly,—and if the wrong one, he is instantly apprized of his mistake by some wink, or shrug, or nod, or gesture, of the teacher. Availing himself of the hint, he retracts the letter first used, and takes up one of the other candidates for the post; and then watches again, to learn if that will do. If mistaken the second time, he tries a third, and finally gets right by the process of exhausting errors,—as the quack dentist succeeded at last in extracting the aching tooth, after having pulled out all the sound ones.

The only proper way for a teacher to conduct the spelling exercise is to put out each word distinctly, giving to it its true English pronunciation,—announcing it, just as a good reader or speaker would do in reading or speaking it,—without any special fulness of emphasis on any particular syllable, or bringing any difficult letter into improper relief,—and without, in fine, giving the slightest hint, intimation or token, by wink, look or gesture, whether the scholar is or is not spelling it right, until he has done,—until the sounds have gone irrevocably forth. This throws the responsibility upon the pupil. He must then study in order to know how each word is spelled. He must *attend* in order to understand what word is put out. He must carry the word in his mind, without confusion or transposition of syllables, until he has spelled it.

If the scholar cannot retain the true orthography in his mind, from the time when he studies his lesson to the time when he is called

upon to spell it, he will not be likely to retain it, and carry it into life, from having the order and succession of the letters intimated or communicated to him, during the period of recitation.

DESPISE NOT SMALL BEGINNINGS.

It is related, in the Gentleman's Magazine, of Chantry, the celebrated sculptor, that, when a boy, he was observed by a gentleman in the neighborhood of Sheffield, very attentively engaged in cutting a stick with a penknife. He asked the lad what he was doing; when, with great simplicity of manner, but with courtesy, he replied, "I am cutting old Fox's head." Fox was the schoolmaster of the village. On this, the gentleman asked to see what he had done, and pronouncing it to be an excellent likeness, presented the youth with a *sixpence*. And this may be reckoned the first money Chantry ever received for the productions of his art.

This anecdote is but one of a thousand that might be cited of as many different men, who, from small beginnings, rose to great stations and influence; and it shows the importance of not despising the day of small things, in any condition or circumstances of life. All nature, in fact, is full of instructive lessons on this point, which it would be well for us more thoroughly to study and appreciate.

The river, rolling onward its accumulated waters to the ocean, was, in its small beginning, but an oozing rill, trickling down some moss-covered rock, and winding, like a silver thread, between the green banks to which it imparted verdure. The tree, that sweeps the air with its hundred branches, and mocks at the howling of the tempest, was, in its small beginning, but a little seed, trodden under foot and unnoticed; then a small shoot, that the leaping hare might have forever crushed.

Everything around us tells us not to despise small beginnings; for they are the lower rounds of a ladder that reaches to great results, and we must step upon these before we can ascend higher.

Despise not small beginnings of wealth.

The Rothschilds, Girard, Astor, and most of the richest men, began with small means. From cents, they proceeded to dollars; from hundreds to thousands; from thousands to millions. Had they neglected these first earnings,—had they said within themselves, what is the use of saving these few cents? they are of not much value, and I will just spend them, and enjoy myself as I go,—they would never have risen to be the wealthiest among their fellows. It is only by the economical husbanding of small means that they increase to large sums. It is the hardest part of success to gain a little; that *little* once gained, *more* will easily follow.

Despise not small beginnings of education.

Franklin had but little early education; yet look at what he became, and how he is now reverenced. Ferguson, feeding his sheep on the hills of Scotland, picked up merely the rudiments of learning, but subsequently rose to be one of the first astronomers in Europe. Herschel, also, the great astronomer, was in his youth a drummer-boy to a marching regiment, and received but little more than a drummer-boy's education; but his name is now associated with the brightest discoveries of science, and is borne by the planet which his zeal discovered. A host of instances rise up to testify that, by pro-

perly improving the small, and perhaps imperfect beginnings of knowledge, they may become as foundation-stones of a temple of learning, which the future shall gaze upon and admire.

A man can scarcely be too avaricious in the acquisition of knowledge; he should hoard up his intellectual gains with the utmost assiduity and diligence; but, unlike the lucre-seeking miser, must put out his knowledge to usury, and, by lending out his stock to others, increase by this commerce of his thought, his capital, until his one talent shall have become five, and his five have gained to them other five.

Despise not the small beginnings of fame or honor.

The fame which springs up on a sudden, like the mushroom plant, is seldom lasting. True fame and honor are of slow, but generally sure growth, ascending by degrees from the lowest offices to the highest stations,—from the regard of a few to the applause of a nation. But he who despises the lower steps of honor because they are low, will seldom reach the higher; and he who spurns at the commendation of his own circle, as too small a thing to seek after, will never secure the esteem and renown of a state or kingdom.

Despise not the small beginnings of error.

The walls of a castle have been undermined by the burrowings of small and despised animals; and the beginnings of error, though at first unheeded, will soon, if not checked, sap the foundations of truth, and build up their own wretched dogmas on its ruins. All first errors are small; despise them not, they will soon increase to great ones, and perhaps devastate society.—*Savannah Georgian.*

Educate your Children early.—What is the object of Education? To form the character. How is this to be done? Not by lessons, but principally through the influence of example, and circumstances, and situation. How soon is the child exposed to these influences? From the moment it opens its eyes and feels the pressure of its mother's bosom,—from that time it becomes capable of noticing what passes around it, and knowing the difference of one thing from another. So powerful are the gradual and unnoticed influences of these early months, that the infant, if indulged or humored, may grow into a petty tyrant at ten months old, and totter about in two years, a selfish, discontented, irritable thing, that every one but the mother turns from in disgust. During this period, every human being is making its first observations, and acquiring its first experience;—passes his early judgments, forms opinions, acquires habits. They may be ingrained into their characters for life. Some right and some wrong notions may take with firm hold, and some impressions, good or bad, may sink so deep as to be with scarcely any force eradicated. There is no doubt that many of those incurable crookednesses of disposition which we attribute to nature, would be found, if they could be traced, to have originated in the early circumstances of life; just as a deformed or stunted tree may come, not from any natural perversity of the seed from which it sprung, but from the circumstances of the soil and situation where it grew.—*Journal of Education.*

"The drying up a single tear has more
Of honest fame, than shedding seas of gore."

[For the Common School Journal.]

CORPORAL PUNISHMENT.

No. III.

To some of my younger brethren, the method which I described in my last number, in order to supersede the necessity of using the rod, will seem to make too great a demand upon their time;—moreover, to savor of weakness, timidity, and inefficiency. "I cannot adopt it," says one; "I must have something more manly, expeditious and authoritative. I cannot consent to stand tampering with a boy's obstinacy. I must come down upon him, and crush it at once." My young brother, so thought I once, but time and experience have taught me better. It is this hot haste, which hurries young teachers into difficulty. You may work quicker with the rod, but will you effect more and better for Education? This is the point which the enlightened educator keeps constantly in view.

But let us look still further at this case. "What if the child will not relent, but in his obstinacy waxes worse and worse? What is to be the ultimatum?" The question must have an answer; and I reply;—It is a matter for the teacher to determine, how long it is proper to continue laboring with the rebellious pupil; whether one day, or one week. This must depend upon the character of the boy, the nature of his offence, and all the circumstances of the case. Whenever the teacher is satisfied that there is no reasonable hope of his relenting, then, at the close of the school and after the others are dismissed, call the offender, and, after reminding him of his offence, and going over summarily the whole ground, expressing your deep regret at the course in which he has chosen to persist, and your desire yet to do him good, say to him very affectionately, that, painful as it is, duty requires you to tell him that he can be your pupil no longer; that you wish him well; that you hope he will think of it properly and see it rightly; and that whenever he shall have come to a better mind, and be willing to conform to school order, you shall be glad to see him and receive him for a pupil again. With this let him take his leave. It is all but certain, that before the lapse of three days, you will find him at the schoolroom door, anxious to come in again, and upon your terms.

Much, very much, depends upon the *manner* of your dismissing a scholar. If you frown upon him, scold at him, tell him to be gone,—that you 'll have no such obstinate, rebellious scoundrel in your school; and especially, if you accompany all this with a cuff or a kick, *a la mode* of by-gone days, he will go away with malice in his heart, and nothing but the authority of a parent will ever turn his steps again to the schoolroom door. And should he once more be put under your tuition, he will do all safely in his power to cause you trouble, and he will hate you as long as he lives. But by the other mode, you will heap coals of fire on his head, and melt down all his obstinacy. And now, my brother, is not this better than to have *kindly* thrashed him into obedience, though it might have been effected at the expense of a little strength and a half hour's time? Try it, try it.

In a similar manner would I treat *all* cases of aggravated disobedience. I would affectionately say to the offender, calling him by name, "I have long labored to make you a good boy and a good scholar. I am sorry I have not succeeded better. You are, and have been for a long time, very disorderly and troublesome. I have often forgiven your trespasses, and exhorted you to do better. In your present course, I can do you no good, while you are constantly hindering and injuring others. I am sorry to be under the necessity of saying that you must withdraw from the school, until you can come hither with better purposes, and attend to the proper business of the school. Whenever you feel that you can be a good boy, I shall be happy to see you again." The whole air and manner of the teacher should be serious, kind, affectionate,—such as to convince the pupil, that this course is adopted from necessity, from principle, from a deep regard to the welfare of the school, and the good of the pupil himself, and not from passion, caprice, pusillanimity or fear. This course would melt down obstinacy. Obstinacy could not stand under the subduing influence of a discipline so kind and so just. Nearly every one dismissed would go away with an aching heart, and soon return, saying, "I repent."

The above consideration effectually meets the most formidable objection which I have ever heard brought against the course I am advocating. The objection is this. "There are in this State over three thousand Public Schools. It is fair to suppose that on this plan, one scholar from each school, on an average, will be dismissed in the course of the winter, for incorrigible obstinacy and disobedience. Here, then, we shall have within the limits of the commonwealth, a troop of three thousand children,—boys running at large, and growing up without education! In the formation of future society, they will make component parts, and give to it their own texture and coloring. Fine materials, indeed, for the formation of society!! The sensitive mind starts back from the contemplation with horror!!"* In answer to this objection, I would say, that we may calculate with much confidence, and much reason too, that of those dismissed, at least, ninety per cent. will return and conduct well. As a compensation for the loss of the rest, I would mention the unspeakably better spirit created in school, which will affect so favorably the thousands of young hearts that are there. I would no longer have it necessary to drive children to school, and to lessons, and to duty, by *stripes*. I would, if possible, make school an attractive place; one to which children would spontaneously resort, and from which they would regard it a great calamity to be cut off. Should the committee object to dismissing a scholar, I might consent, as a last and doubtful experiment, to try the rod; FOR ORDER WE MUST HAVE.

So, if I found myself in a school which had become notorious for violence, rudeness and insubordination, I might, at the commencement, hold up to the scholars the rod *in terrorem*, until I could bring higher and better motives to bear upon them. It should be however only for a season, and, (as I would keep a wild animal or

* For our views of the expediency of dismissing refractory children from school, see Common School Journal, Vol. III., pp. 66, 67.—ED.

mad dog at bay with my staff,) until I had gained somewhat upon their confidence and esteem. But for a school of this character, especially if the scholars were large, and many of them boys, I would like to try the experiment, as the most probable cure, of employing a female teacher of decided character, high cultivation, and refined manners. I believe it would be the best thing that could be done for it. No medicine would be equal to the influence of such a woman, in softening their hearts and polishing their manners. It would be all but omnipotent. O what a miracle of change her example would effect in the rough and clownish manners of that boorish set! I would recommend to committees who may be unfortunate enough to have the supervision of such schools, to make the trial. But on this point it is not my purpose at this time to enlarge.

I can now conceive of but two more objections to the principle I am advocating. It seems to me that they exhaust the subject. I proceed to state, and to reply to them.

I. It may be said, that in a large school of one or two hundred scholars, several cases of disobedience and rebellion may come up in so quick succession, that the teacher cannot dispose of one before the others occur, and thus they may accumulate upon his hands.

On this supposable, though not very probable case, I will make two or three remarks.

If a teacher, such as I have attempted to describe,—one possessed of the right qualifications, and spirit and motives,—goes into school, and pursues such a course as I have pointed out, the case supposed will not be very likely to occur; indeed it will be very unlikely. Should not this be found to be true, on a fair trial, I will engage to abandon my ground, and say not another word in its defence. But the experiment must be *fairly* tried, and by the *right sort* of teachers. I am reckoning much upon the *prevention* of evil. There is one great mistake into which those who argue on the other side, are constantly running. They all the time labor under the impression, that the same difficulties will arise under the *mild and suasory system*, consistently and firmly pursued, as under the discipline of the rod, and when all is carried by mere authority and force. This is a mistake. I believe most school difficulties grow out of something faulty in the very *discipline and rule* of the school, —and that they would cease and be unknown, if these were changed and made what they ought to be. Those on the contrary side, have no right to say that it would not be so, until they have tried it, and that, faithfully; tried it, not as the apostle says some preached the gospel, "*of contention*," but "*in love*." In morals, as in chemistry, you may *so* try an experiment that it will certainly fail. I do not claim for my system, a power either to prevent or to cure all the evils of the schoolroom. No scheme does this. The best ever proposed has only approximated to it. I only say that this system is attended with fewer difficulties,—works better for the cause of education,—than any system of government which is based essentially on corporal punishment. This is *all* I say. Now I do not believe, that in a school of a hundred pupils, managed in the way that I would have it, a case of the kind supposed would occur once in a hundred years. I never knew a single, solitary instance of it, and I have had some experience. But I have known, and in more than one instance, in schools where the rod and strap and ferule bore

sway, from four to a dozen boys drawn up for chastisement at the *close* of the school, or in the *recess*. But allow that the case may happen,—yea, that it *has* happened,—that here it is before you. What then? What shall be done? I would treat it substantially as I have pointed out for a *single individual;*—the whole dozen together, or by parcels,—or each one separately, as might seem best. This course, it is true, will require more time and *patience*, than would be necessary to give each offender a good strappado, and let him go; but I am satisfied that it would better subserve the cause of education.

II. Again; I think of one other emergency, which may be pressed as an objection to the plan of banishing the rod and the cudgel from the schoolroom. It may be asked, "What would you do in case of a league or combination among the scholars? When the Titans arise, would you not smite them with thunder?" No. Let me put a strong case. A half dozen, or more, of large scholars combine to put the teacher out of school. What can be done then by moral suasion, and kind tones, and pleasant and earnest entreaties? Of this case I am disposed to say much the same as the ancient Law-giver did of Parricide. He would make no law against it, for it is a crime that never could take place. Combinations and attempts to turn teachers out of school, are very rare occurrences. When they have taken place it has generally been under a system of petulance, neglect and abuse, on the part of teachers. Under such teachers and such school regime as I have been describing, they are, indeed, all but *impossible.* It has been often remarked, (and I once heard Mr. Taylor, the seamen's preacher, repeat the observation when speaking from a ship's deck,) that all mutinies among sailors may be traced to the *cabin.* I believe the spirit of the remark holds true of school mutinies. Scholars are mutinous, because teachers are indiscreet, tyrannical, unjust. But in the emergency supposed, I do not see that the knight of the rod and ferule would have any advantage over one who has discarded these insignia of the pedagogue. What would the rod avail in such a crisis? Suppose the teacher were a female, (for females keep schools of large scholars, and winter schools too,) or suppose the teacher were a man of ordinary size, and of strength and *weight* of character, and that the pupils, (every one of whom singly is more than a match for his teacher,) are resolved on, yea, are in the very *act* of, putting their threat into execution, would you advise the teacher, man or woman, to rush on, and attempt to lash the rebels into subordination? Can any person be so devoid of discretion as to advise to such a course? Would it not be better for the woman actually to be put out of school, than to engage in a fight in which she would be sure to get the worst of it? And if it would be better for the woman, would it not be better for the man also? If you say the teacher's desk is his castle, and that he may, and should, defend it, at all hazards,—why then, put into his hands the club of Hercules, or rather the pistol and bowie-knife, and let him make quick work of it. I once knew a Vermonter to carry an axe into school with him, and threaten to lay open the skull of the first scholar who should assail him. This was carrying out the principle to its ultimatum.

It is not easy to prescribe for the emergency supposed on any principle. Perhaps it is as well to let the occasion suggest what is to be done. Of one thing I am sure; viz., that the advocates of the

rod would have no advantage over him who discards it. If the teacher were aware that such a movement was brewing, it might be well to call the committee together and lay the whole subject before them in presence of the school. This, the teacher who from principle has refrained from the use of the rod, can do without the hazard of being charged with cowardice, or of standing in fear of the great scholars,—a charge which the knight of the rod, or the advocate of corporal punishment, would hardly escape, should he take such a step. I cannot but think, therefore, that rebellions would be less frequent, and more easily managed on my principles than on the contrary. Try them truly; faithfully. Do not commit the trial to a blusterer or swaggerer. He will surely fail. Such a man must keep a poor school on any principles.

I believe I have now given my views fully on the use of Corporal Punishment in school. I have great confidence in their truth and practicability. I have tried them much and long, and with success. My only apprehension is that my younger brethren will not have faith and patience enough to give them a fair trial. They will grow impatient and begin to doubt. They will not try the plan in the right way, or will not pursue it to the end. But after all, some one may say, "Why not apply the rod? Here is an ugly fellow, that deserves a *striping;* and he may be brought to his senses in five minutes by the cowhide. Why not turn to and give him a smart *colting?* Then the matter will be got through with." This process is indeed a very summary one, and very tempting to young and hasty spirits; but it is by no means certain that it *will* cure the evil; it is a discipline of needless severity and of a low order; it does not promote real education, but often throws it back rather; and it has too long been the reproach of our teachers and schools;—a discipline more befitting the negro plantation, the military camp, or the man-of-war's deck, than the juvenile seminary. I do not expect to make converts of *all* to my views. With some it would be a long step. Others, it would cost too much; for this whipping is thought to be quite a labor-saving process. It will be a great crucifixion of the *animal* nature,—of combativeness and self-esteem. Its adoption would doubtless cost some their schools; for there are those who cannot possibly keep school without the cowhide or the cudgel for their aid-de-camp.

Let none treat these views as visionary. I know they are practical. Be kind,—be firm,—be dignified,—be uniform, at *all times* and to *all scholars*, and *you will* succeed. And you will witness such a change in your schoolroom, as you might expect to see, I will not say, with a friend of mine, in a transfer from pandemonium to paradise, but in a transfer from earth to spheres celestial.

In my next, I may take up classification of scholars in a school, and touch upon some other points of order. P.

"THE RIGHT KIND OF BENEVOLENCE.—A few days since, in New Haven, while a horse was running away with a wagon, which contained a youth, who was momentarily expecting death in its worst form, a woman was seen rushing through the crowd, endangering her own life to rescue that of the lad. 'Hold! hold!' said a dozen persons who saw her danger, and seized her by the arm, 'is he your son?' 'No, no,' said she, urging her way onward, '*but he's somebody's son!*'"

VENTILATION AND WARMING.

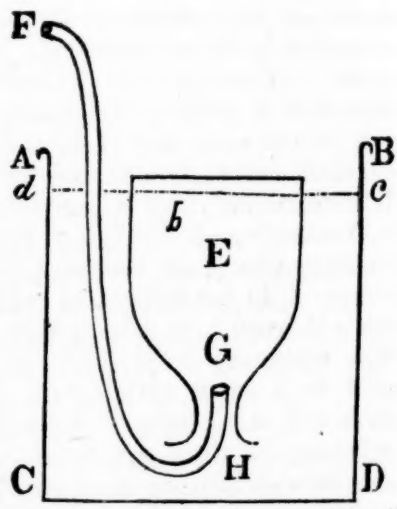
[The following essay on Ventilation and Warming was written by the late Dr. Wyman, of Roxbury, and has never before been published. Dr. Wyman was practically, as well as theoretically, conversant with the subject. It was while he was superintendent of the McLean Asylum for the Insane, at Charlestown, Mass., and under his direction, that the buildings, now occupied by the insane at that place, were erected.

We commend the article to the study of all those who have anything to do with the erection of schoolhouses, or with the regulation of the air and the temperature in schoolrooms.—ED.]

A necessity of Ventilation, in private and public buildings, arises from changes produced in the air by the respiration of the inmates. The air taken into the human lungs is not fit to be inspired again. It will not support animal life, or combustion.

The fact now stated may be proved by a very simple experiment. Let a common quart decanter be filled with water, and inverted with its mouth under water in any convenient vessel, as a common water pail, into which a tube may be introduced for the introduction of air from the lungs.

A B D C the pail. E the decanter. H its mouth. *b* surface of water in decanter, level with surface *d c* in the pail. F G bent tube passing through H.



Make a full inspiration, and with the extremity of the tube F in the mouth, and the nostrils closed, expire the air from the lungs through the bent tube F G into E. As the surface *b* descends, raise the decanter, that *b* and *d c* may be on the same level. Inspire and expire, until the decanter is filled with air which has been breathed once.

Remove the decanter, keeping it inverted, and introduce a lighted candle. The candle will soon go out, showing that atmospheric air once breathed will not support combustion. If small animals, as mice, be introduced, they will soon die, for it is unfit for respiration.

What is the change in the air produced by respiration?

One hundred parts by measure of pure atmospheric air consist of 79 parts of nitrogen gas and 21 parts of oxygen gas. There is, however, usually about 1 per cent. of other gases and of aqueous vapor. Thus it is when inspired. When expired, the vapor is greatly increased, the nitrogen gas is little changed in quantity, the 21 parts of oxygen are reduced to 16 parts, and the five parts of oxygen, which have disappeared, are replaced by 5 parts of carbonic acid gas.* This gas consists of 72 parts of oxygen by weight and 28 parts of carbon. The carbon is derived from the dark

* Others state that the oxygen is reduced to 12.5 and the carbonic acid gas formed is 8.5.

purple blood in the lungs, discharged into the air cells, whereby the color of the blood becomes bright red. The carbon combines with a portion of the oxygen in the cells, forming carbonic acid gas, and the gas thus formed is precisely of the same volume with that of the oxygen used,—that is, the volume of the oxygen gas is not increased by its combination with the carbon.

The air expired also contains moisture. The exhalations from the lungs amount to 1 pint of liquid in 24 hours.

The air is also contaminated by the perspiration from the skin, which amounts to 2 pints of liquor in 24 hours. The water, 3 pints, thus discharged into the air surrounding human beings, partakes of the odor arising from food and drinks, and of the scent peculiar to each individual,—that scent by which the dog follows the steps of his master. It is this odor and scent which are offensive in crowded rooms, without ventilation.

The air thus contaminated by vapor, odors and carbonic acid gas, although it may contain a portion of oxygen gas, is, as a whole, unfit for respiration. It must be carried off, and not enter the lungs a second time. If in a common room the air once breathed be mixed with a portion of the pure air remaining, the latter will be contaminated. Although the mixture may at first imperfectly support life, yet every repeated respiration increases the impurity; and finally, the impurity becomes so great that the mixture is unfit to be breathed.

I have said the air once breathed must be carried off. It is true that in schools and other crowded apartments, the inmates often remain daily, for several hours, in very impure air, and escape alive. So did some survive a dreadful night in the "black hole prison" at Calcutta. So, too, some persons,—as the two girls employed by Du Hamel and Tillot, in ovens heated to 260°, 288° and 325° of Fahrenheit, Dr. Fordyce, Dr. Blagden and others, in rooms heated to 240°,—have endured temperatures almost exceeding belief. But it does not follow that the subjects who may escape with life, do also escape without injury. Nor can we conclude that nature could so soon repair the injury, if the exposure were longer continued or more frequently repeated. The effects of a more constant confinement in impure air, are seen in the pale faces and feeble bodies of those who work daily, from early to late hours, in badly ventilated factories, and sleep in worse ventilated bed-chambers. Air rendered impure by respiration prostrates the powers of the body, obscures the clearness and suspends the activity of the intellect, oppresses the feelings, and finally produces stupor and profound insensibility, and in extreme cases actual death. If impure air be thus injurious, in the mature and most vigorous period of life, it will be more injurious in the forming, or growing and less vigorous periods of childhood and early youth. In the Lying-in Hospital at Dublin, the deaths of children, before ventilation, were 1 in 6; after ventilation the deaths were reduced to 1 in 20.

Practical ventilation consists in the removal of foul air, and supplying its place with fresh atmospheric air. It is vain to think of purification by any chemical process. There is enough of pure air at hand. It is the freest and most abundant of God's gifts. It comes alike to all men, unseen and unfelt, by night and by day, asleep and awake, without the care or thought of man.

Ventilation is produced by nature in two ways. The first method is by winds. These penetrate caverns, sweep over the widest

deserts, the deepest forests and foulest morasses, driving away the malaria and filling the places with pure air. They operate incessantly in every region, from the tropics to the poles.

In particular places and for special purposes, nature ventilates by another method. In places or apartments occupied by human beings, from which the winds are excluded or to which they are not admissible, ventilation is effected by the increased temperature of the air expired. In a common room, a man, without exercise, in winter clothing, requires the temperature of the air around his body to be about 65°. In summer clothing the temperature must be about 70, or he will feel chilly and uncomfortable. In ordinary cases the temperature of the air expired will be between 88° and 96°, say 92°. It will contain aqueous vapor. Any given volume of a mixture of atmospheric air and aqueous vapor is much lighter than an equal volume of pure air. From these two causes,—heat and vapor,—the air expired will be lighter than that around the body, and will ascend towards the ceiling of the room. If there be in the ceiling a sufficient opening into a sufficient flue, the lightest and uppermost stratum of air will escape, with a velocity depending upon a variety of circumstances; one of which is indispensable, viz., a sufficient inlet for fresh air; for if no air can come in, none will go out,—for the same reason that liquor will not run from a barrel without a vent-hole. But the inlets of fresh air, especially those of windows and doors, produce cross currents, which render some seats uncomfortable, and expose some occupants to take colds. It is, therefore, better that other inlets be provided, and so arranged that they may be open even during rains and storms.

How much ventilation is required for healthy respiration? An adult person takes into the lungs 40 cubic inches of air at each inspiration, and expires the same quantity. He makes 20 inspirations in a minute, and consequently every minute renders 800 cubic inches of air unfit for respiration, equal to $3\frac{1}{2}$ gallons per minute, or 48,000 cubic inches, = 208 gallons or $27\frac{3}{4}$ cubic feet per hour. This estimate supposes the air expired to be entirely removed and not mixed with any portion of the unrespired air. But it does mix with and contaminate a portion of pure air, and both ascend and pass off together through the ceiling. It is for this reason, that the supply of pure air should exceed the amount of air vitiated by respiration, as deduced from the data first stated. Hence Professor Faraday, F. R. S., &c., stated to the parliamentary committee, that the supply should be from 10 to 20 gallons per minute for each person. Take the mean, which is 15 gallons per minute, or 900 gallons, = 120 cubic feet per hour for each person. Inman assumes 30 gallons per minute, and consequently concludes that the air should be changed every half hour.

If the exterior walls of a building be 60 by 40 feet, the interior as finished, allowing for desks, seats, platforms and the bodies of the inmates, may be taken at 57 by 37 feet, = 2109 square feet for floor, —if the height be 12 feet, the contents will be 25,308 cubic feet, and this divided by 120, (cubic feet for one person one hour,) shows a sufficient quantity of air for (25,308 ÷ 120 =) 211 persons one hour;* i. e., the air in a room of the dimensions supposed, and containing 211 persons, should be wholly changed every hour. This probably is a

* Tredgold, from other data, requires 48,000 cubic feet per hour for 200 persons, or 240,000 for 1000 persons.

smaller amount of ventilation than ought to be provided for. Provide for enough. It is easy to diminish, by valves in the outlets and inlets.

What must be the area of the inlet, or the sum of the inlets, necessary for the degree of ventilation proposed, or for the admission of 25,308 cubic feet of air per hour?

The velocity of a pleasant, brisk breeze is 15 feet per second, or 900 feet per minute, or 54,000 feet per hour. With this velocity an inlet one foot square will admit 54,000 cubic feet of air per hour. Hence 54,000 c. ft.: 144 sq. in. :: 25,308 c. ft.: 67½ square inches, the area of inlet required. Hence an inlet of half a square foot, with a velocity of 15 feet per second, will admit 25,308 cubic feet of air per hour.

The velocity of air in a common chimney is from 4½ to 6 feet per second, say 5 feet per second, or 300 feet per minute, or 18,000 feet per hour. With this velocity an inlet one foot square will admit 18,000 cubic feet of air per hour. Hence 18,000 c. ft.: 144 sq. in. :: 25,308 c. ft.: 202½ sq. inches, the area of inlet required. Hence an inlet 15 by 14 inches = 210 sq. inches, will admit 25,308 cubic feet of air per hour, if the velocity be 5 feet per second.

Thus far the air admitted has been supposed to require no artificial warming; as in summer, when the inlets may be the doors and windows. If other inlets be provided near the floor to prevent cross currents, they should all have dampers and be connected with one main flue, which should have a turncap facing to the wind, to receive air in all directions. The outlets in the ceiling should also have dampers, and the opening in the roof should have a turncap, facing from the wind. These arrangements, perhaps, are all that are required at present for summer ventilation.

In winter the air admitted must be warmed. It must be mixed with air near the floor, or it will neither be breathed, nor directly warm the air around the inmates, where its heat is most needed. Air heated by a furnace usually enters the room near the floor in one column. Being hotter and lighter than the air already there, it ascends directly to the ceiling, causing the upper stratum of air to descend beneath it. Its temperature varies from 150° to 250°, and is often so high as to melt tin and lead, and sometimes to ignite wood. It is the lightest air, and remains at the top. It cannot descend, until it becomes cooled, and is displaced by a supply of hotter air from the furnace. It is also the purest air. If the outlets in the ceiling be opened during this process, the warmest and the purest air in the room passes into the roof, and thence into the open air, to warm "the region round about." David Boswell Reid, M. D., F. R. S. E., stated to the parliamentary committee, that "great sums (are thus) thrown away;" that he "has seen, at twenty or thirty feet from the floor, a stratum of air above boiling-water temperature, while below, the air was disagreeably cold." p. 58, In. Rep.

I have said that the hot air passing in a column to the ceiling does not *directly* warm the air near the floor. It does, however, produce this effect *indirectly*. It heats the ceiling and upper parts of the walls, and these radiate heat to the floors, desks, seats, and inmates, just as a brick wall, heated by the sun, radiates heat to buildings or persons on the opposite side of the street. These desks, seats, floor, &c., thus warmed, impart heat to the air which is in contact with them only. It is a well-established fact that

rays of heat, passing through clear air, do not warm it. If we depend upon the heated ceiling and walls to warm the floor, the ceiling and upper parts of the walls should be double-plastered, and the circulation of cold air behind them should be entirely prevented, so that the heat of the walls and ceiling may not be conducted away. The windows should also be double, to prevent the cooling of the warm air by contact with the cold glass. It is in this way that wooden shutters contribute to the warmth of our houses. But this plan of admitting air and warming rooms is wholly inconsistent with *openings at the top* for ventilation.

A very different plan was adopted for warming and ventilating the new Parliament house in England. Although it cannot be adopted for common purposes, it may be well to know the means used and the principles involved.

In a basement or mixing room, as it is called, the air is tempered, uniformly, by a mixture of hot and cold air, so that the whole mixture shall be of one temperature, 55° to 60°; and this low temperature is taken, because the temperature of the air will be increased as it rises in the room above in contact with the inmates. The ceiling of the basement and the floor over it are pierced with a great number of holes, through which the warm air passes up imperceptibly, as, part of it being breathed, and thereby its temperature being further increased, it rises to the ceiling, and passes out, never to return. As this spontaneous escape of the foul air will not be uniform, and the ventilation will be variable, the outlets in the ceiling are made to open into flues, which are connected with chimneys constructed and heated specially for the purpose of ventilation, and the foul air passes off through these chimneys. By adjustment of the valves, and of the heat of the fires, any desired degree of ventilation may be produced, and by change of temperature in the basement, any desired temperature in the room above it may be obtained.

The ventilation of the Parliament house resembles the second method of nature, (page 92.) It is the most perfect. It is also the most expensive, and cannot be easily adopted in buildings not originally constructed for it.

In some large buildings and factories the foul air has been drawn off by machinery, moved by steam or water power. But, when these powers are not already in operation for other purposes, the side chimneys in the room to be ventilated, or in other parts of the building, with adequate open fires, will be cheapest, most easily managed, and will ensure any degree of ventilation proposed.

If means for uniformly mixing the warm air, as introduced, with the cold air near the floor, cannot be provided, the next best method of introducing hot air for schools, or at least in all buildings now erected, is that commonly adopted. It is true the air rises directly to the ceiling, parting with a portion of its heat, and descending lower and lower, as successive additions of hotter air arrive from the furnace. The upper stratum is purest and warmest, and should never be allowed to escape until brought down for the respiration and warming of the inmates. The ventilation of rooms thus warmed must be by outlets near the floor. As the air is drawn off below, the warm and pure air above will descend, and the place of that next the ceiling will be supplied from the furnace. This change of air cannot be effected by spontaneous ventilation through flues in cold, brick, exterior walls. If the smoke flues and hot air flues were

adjacent to the ventilating flues in an interior wall, it is possible that a sufficient current might be produced a part of the time; and so it might in wooden flues within the room, and warmed by the surrounding air. Sometimes these flues would totally fail, and very often be deficient, and always variable in effect. They would fail in mild weather, when there would be but little difference between the temperature of the internal and external air. They would also fail under particular directions and forces of the wind. An open fire in a large chimney, in a side room, or in the room itself, will draw off the air from the floor. The door of the side room may be shortened so as to have an opening at the top and the bottom of the doorway, each opening having a valve, that either or both may be used, as experience shall show to be most beneficial. The best position for a ventilating fire and chimney is in a small close room in the basement, especially if several stories are to be warmed. To this ventilating room the air near the floor in each apartment may be conveyed down in wooden flues through the stories below. The ventilating chimney will also receive the smoke pipes of all the furnaces. The heat from the smoke of the furnaces will assist in causing the current in the chimney for ventilation.

In small schoolrooms, warmed by cylinder or box stoves, wooden flues may produce sufficient ventilation, if there be a turncap in the roof, and fresh air be admitted under and around the stove, so as to be warmed by it.*

The old method of warming schoolrooms in Boston was good, and much better than some methods since adopted. It consisted of a box stove near the door, the funnel passing under the ceiling to a chimney in the opposite side of the room with an open fire. All that was needed to complete this plan was an inlet of cold air around the stove. If the air be admitted warm from a furnace, then the stove and inlet under it may be removed; and if the air near the floor be conducted to a ventilating room in the basement, instead of passing up the chimney of the room, the chimney and the open fire in the schoolroom will not be needed. But this arrangement brings us back to the plan on the last page. The plan, however, is not perfect. It is liable to some objections. Some of the air must be breathed a second time. The portion thus breathed will be less than by any other plan, except that of the Parliament house.

Steam pipes are admirable for *radiating* heat and warming buildings; but they have not been successfully combined with effective ventilation in crowded rooms.

In warming the air, steam pipes and plates are used in the basement for Parliament. If air furnaces be used, each apartment, or at least each story, should have a separate furnace and a separate supply of cold air. When only one furnace is used, the upper story can take all the heated air, and every lower story is dependent on all those above it. There is a want of economy in using large furnaces. When the heat is very intense, it is believed that the heat produced is not in proportion to the fuel consumed. It is certain that the loss of heat by the smoke and the destruction of furnaces by the intensity of the heat, are much greater in one large furnace,

**Wheeler's Patent Stove* is an excellent stove, of the construction referred to in the text, for warming small, or ordinary sized schoolrooms. They are made at Worcester, Mass., and for sale there, at Boston, and elsewhere.—Ed.

than in several small furnaces, equivalent to it in warming air. If the large furnace needs to be repaired, each apartment connected with it will be without means of warming. The smoke flue from each furnace should have a damper. Each cold air flue should have a damper, and also a swing valve, to be closed by the force of the wind, just in proportion to the velocity of the current; so that a uniform quantity of air may arrive at the furnace, whatever may be the force of the wind.

Every method of ventilation requires an extra consumption of fuel in cold weather. As often as the air in a room shall be changed, so often will be expended an amount of heat, sufficient to raise the temperature of a volume of cold external air, equal to the volume of air in the room, from the temperature at which it enters the air-chamber of the furnace to the temperature at which it escapes from the room. This expenditure of heat cannot be avoided, if there be ventilation. It will be in proportion to the degree of ventilation, and must always be considered in comparing one heating apparatus with another.

"A CURIOUS FACT IN ASTRONOMY.—We state the following on the authority of M. Arago, the eminent French astronomer:—If we place, in a horizontal line, a series of figures, of which the law is evident, each doubling the preceding:

0 3 6 12 24 48 96 192

—and afterwards add four to each, we should have a series denoting the relative distances of the planets from the sun. Thus:

4 7 10 16 28 52 100 196

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus. If 10 represent the distance of the Earth, 4 will be that of Mercury, 6 Venus, 16 Mars, and 52, 100, and 197, the respective distances of Jupiter, Saturn and Uranus. This law was known as far as 100 before the discovery of Uranus: and the distance of that planet being found to correspond, affords a very remarkable confirmation of its truth. But it will be observed, there will be a deficiency of one term between Mars and Jupiter, at the proportional distance of 28 from the Sun. At this point a small planet was some time since discovered. This planet was named Ceres; and since, three others have been found,—Pallas, Juno, and Vesta; all of which have their orbits so near each other, as to lead astronomers to believe that they are fragments of a larger planet, which had been shattered into pieces by some internal explosion, or the shock of a comet."

BRIDGEWATER NORMAL SCHOOL. The next term of the Bridgewater Normal School will commence on Wednesday, the 29th inst. All who intend to present themselves for admission at the school, are requested to do so on the first day of the term.

N. TILLINGHAST, *Principal.*

Bridgewater, March 15, 1843.

LEXINGTON NORMAL SCHOOL. The next term of the Lexington Normal School will commence on Wednesday, the 3d day of May next. All who intend to present themselves for admission at the school, are requested to do so on the first day of the term, and to bring with them a Bible, Worcester's Pronouncing and Explanatory Dictionary, Worcester's Geography and Atlas, Porter's Rhetorical Reader, Colburn's First Lessons, Sequel and Algebra.

Lexington, March 15, 1843. SAMUEL J. MAY, *Principal.*

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